

turnbuckles or equally efficient securing devices for drawing the cargo tank down tight on the frame. Anchors, stops, or other means must be provided to prevent relative motion between the cargo tank and the vehicle chassis when the vehicle is in operation.

(b) A cargo tank motor vehicle designed and constructed so that the cargo tank constitutes in whole or in part the stress member used in place of a frame must have the cargo tank supported by external cradles. A cargo tank mounted on a frame must be supported by external cradles or longitudinal members. The cradles, where used, must subtend at least 120 degrees of the shell circumference. The design calculations for the supports must include beam stress, shear stress, torsion stress, bending moment, and acceleration stress, for the loaded cargo tank motor vehicle as a unit, using a factor of safety of 4, based on the ultimate strength of the material and on a 2 "g" longitudinal and lateral loading and 3 times the static weight in vertical loading (see appendix G of the ASME Code).

(c) Where any cargo tank support is attached to any part of a cargo tank head, the stresses imposed upon the head shall be provided for as required in paragraph (b) of this section.

(d) No cargo tank support or bumper may be welded directly to the cargo tank. All supports and bumpers shall be attached by means of pads of the same material as the cargo tank. The pad thickness shall be no less than ¼ inch, or the thickness of the shell material if less, and no greater than the shell material. Each pad shall extend at least 4 times its thickness, in each direction, beyond the weld attaching the support or bumper. Each pad shall be preformed to an inside radius no greater than the outside radius of the cargo tank at the place of attachment. Each pad corner shall be rounded to a radius at least one-fourth the width of the pad, and no greater than one-half the width of the pad. Weep holes and telltale holes, if used shall be drilled or punched before the pads are attached to the cargo tank. Each pad shall be attached to the cargo tank by continuous fillet welding using filler material having properties conforming to the rec-

ommendations of the maker of the shell and head material.

[Order 59-B, 30 FR 581, Jan. 16, 1965. Redesignated at 32 FR 5606, Apr. 5, 1967, and amended by Amdt. 178-29, 38 FR 27598, Oct. 5, 1973; Amdt. 178-85, 51 FR 5977, Feb. 18, 1986; Amdt. 178-88, 52 FR 13046, Apr. 20, 1987; Amdt. 178-118, 61 FR 51340, Oct. 1, 1996]

#### § 178.337-14 Gauging devices.

(a) *Liquid level gauging devices.* See § 173.315(h) of this subchapter.

(b) *Pressure gauges.* (1) See § 173.315(h) of this subchapter.

(2) Each cargo tank used in carbon dioxide, refrigerated liquid or nitrous oxide, refrigerated liquid service must be provided with a suitable pressure gauge. A shut-off valve must be installed between the pressure gauge and the cargo tank.

(c) *Orifices.* See § 173.315(h) (3) and (4) of this subchapter.

[Amdt. 178-29, 38 FR 27599, Oct. 5, 1973, as amended by Amdt. 178-89, 54 FR 25018, June 12, 1989; Amdt. 178-118, 61 FR 51340, Oct. 1, 1996]

#### § 178.337-15 Pumps and compressors.

(a) Liquid pumps or gas compressors, if used, must be of suitable design, adequately protected against breakage by collision, and kept in good condition. They may be driven by motor vehicle power take-off or other mechanical, electrical, or hydraulic means. Unless they are of the centrifugal type, they shall be equipped with suitable pressure actuated by-pass valves permitting flow from discharge to suction or to the cargo tank.

(b) A liquid chlorine pump may not be installed on a cargo tank intended for the transportation of chlorine.

[Amdt. 178-89, 54 FR 25018, June 12, 1989, as amended by Amdt. 178-118, 61 FR 51340, Oct. 1, 1996]

#### § 178.337-16 Testing.

(a) *Inspection and tests.* Inspection of materials of construction of the cargo tank and its appurtenances and original test and inspection of the finished cargo tank and its appurtenances must be as required by the ASME Code and as further required by this specification except that for cargo tanks constructed in accordance with part UHT of the ASME Code the original test